REMARKS

- Claims 1-4 and 6-20 were previously pending.
- Claims 1, 2, 14, and 15 are currently amended.
- Claims 1-4 and 6-20 are currently pending.

Information Disclosure Statement

The IDS filed 13 January 2011 was found noncompliant. Applicant will attempt to correct the deficiencies and refile the IDS with the needed references.

Reply to Examiner's Response to Applicant's Previous Arguments

Some of the claims have been amended to clarify the subject matter. No new matter is added.

In this section of the Office Action (pages 2-4), the Applicant does not necessarily agree with all of the Examiner's characterizations of Applicant's past arguments. Applicant would like to retain the right to refute these characterizations at a later time, if necessary.

Claim Rejections Under 35 USC § 103(a)

Claims 1-4 and 6-20 were rejected under 35 USC § 103(a) as being unpatentable over **Haugen** et al., "Simulation of Independent Reservoirs Couple by Global Production and Injection Constraints," in view of **Briens** et al., "Application of Sequential Staging of Tasks to Petroleum Reservoir Modeling," in view of U.S. Patent No. 6,108,608 to **Watts**, "Method of Estimating Properties of

a Multi-Component Fluid Using Pseudocomponents," in view of **Scott** "Application of Parallel (MIMD) Computers to Reservoir Simulation."

Haugen

Applicant's specification (Publication No. 2007/0112547) specifically distinguishes Haugen from the claimed invention, at paragraph [0048]. (One of the authors of the Haugen reference is an inventor in the instant patent application.) The Haugen "coupled simulation" is limited to "black oil simulators." In Haugen, the simulators couple to each other: one simulator is designated master and one or more other simulators are slaves.

In contradistinction to Haugen, the claimed controller ***exists apart from*** all of the simulators being coupled, yet is able to couple with all of these simulators, to orchestrate an overall oilfield simulation involving all of the coupled simulators. The claimed controller has the coupling algorithms within itself. But the claimed controller is not itself a simulator…but instead, a controller.

Watts

Watts describes pseudo-components: utilized to estimate properties of a multi-component fluid. Watts does not teach, suggest, or contemplate an autonomous controller that can couple with simulators running different fluid models.

Scott & Briens

Scott and Briens were discussed at some length in the previous Office Action Responses.

The Applicant does not agree that the Scott reference (1987) and the Briens reference (1990) should be applied as prior art to the claimed subject matter, and respectfully traverses the rejections, as they now stand, that include the content of these references.

To orient in time to the years 1987-1990, when Scott and Briens were published, MS-DOS 3.3 (operating system) was just released in 1987. IBM just released the VGA video standard that year. In 1988, Motorola introduced the 88000 processor, and Intel introduced the 80386sx processor. In 1989, Intel just introduced 486DX processor, "with more than 1 million transistors and multitasking capabilities." DEC PDP and VAX products were arguably the most popular minicomputers for the scientific and engineering communities, precursors to the early PC's bearing the above-mentioned 386 and 486 processors. The 15 inch diameter DEC data cartridge for the more powerful minicomputers held only 10 Megabytes. All of the above technologies are now regarded as museum-pieces (with the exception that VGA is still a standard for legacy TV tuner cards).

This means that a company or other entity seeking to computer-simulate a ***single*** hydrocarbon reservoir model in 1987-1990 was left with a set of unpleasant choices:

- temporally simulating a multi-million-cell 3D grid model of the reservoir was out of the question;
- modeling a simplified version of a grid simulation to represent the reservoir would be unsatisfactory and very slow (Briens considers only 1000 grid cells to be large-scale): so a **single** iteration of a simulation of a good size modeling grid on 386 or 486 processors

could take days or even weeks, let alone enough iterations to qualify as a simulation;

- at the time Scott and Briens were published, a more advanced computer to speed up the simulation would be very expensive.

In answer to these unpleasant choices, the Scott and Briens references rightly invoked staging and allocating these tasks, at the lowest level of known computer architecture, among the processors. The term "parallel computing," as used in these references appears to mean the same as the current "parallel computing" term of art. Likewise, the term "synchronous communication" as used in these references, appears to mean the same as the current term of art. Thus, for example, "synchronous communication" in these references tends to mean synchronous data transfer in accordance with the usual usage of that term of art, and does not appear to relate in any direct way to the type of "synchronization of time steps between different reservoir models being simulated in real time" that is the subject of Applicant's claims.

Hence, the Applicant has no argument against the Examiner's position that parallel computing would speed up the computation of a processor-intensive reservoir model simulation, or that multiple simulations could run on multiple processors, and be communicatively coupled with each other, to advantage. What is not clear, is how these true things apply to the claim elements.

Independent Claims 1, 2 and 14

Independent Claims 1, 2, and 14 have been amended to more particularly point out and distinctly claim the subject matter recited. Applicant submits that

the claims as now recited overcome the combination of Haugen, Briens, Watts, and Scott. None of these references, alone or in combination, teach, suggest, or contemplate a standalone controller (or a method) that interfaces with diverse independent surface network simulators, black oil reservoir simulators, and compositional reservoir simulators, and that synchronizes these simulators under a variable time step that the controller chooses that allows the simulators to progress with their own times steps using their own 3D grid cell models. The Applicant respectfully requests that the rejection under 35 USC § 103(a) be removed, and the claims be allowed.

The claimed controller's dialog with a given simulator is described in paragraphs [0019]-[0031] of the specification.

The coupling scheme used by the claimed controller between a single reservoir and a surface network is described, among other places, in paragraphs [0032]-[0037].

The network/reservoir balancing across time steps provided by the claimed controller is described in paragraphs [0038] –[0045].

The coupling scheme used by the claimed controller between multiple reservoirs and a surface network is described, among other places, in paragraphs [0049]-[0050].

The network/reservoir balancing across time steps provided by the claimed controller for a multi-reservoir and surface network coupling is described in paragraphs [0051] –[0052].

The translating of black oil and compositional models to a common fluid model by the claimed controller is described in paragraphs [0053]-[0070].

Claims 9-13

Claims 9-13 include the all the language and limitations of their base claim, claim 1. Thus, Applicant suggests that since claim 1 is allowable, claims 9-13 are allowable in turn.

Claims 3-4 and 6-8

Claims 3-4 and 6-8 include the all the language and limitations of their base claim, claim 2. Thus, Applicant suggests that since claim 2 is allowable, claims 3-4 and 6-8 are allowable in turn.

Claims 15-20

Claims 15-20 include the all the language and limitations of their base claim, claim 14. Thus, Applicant suggests that since claim 14 is allowable, claims 15-20 are allowable in turn.

Conclusion

Applicant submits that the pending Claims 1-4 and 6-20 are in condition for allowance and respectfully requests issuance of the subject application.

Respectfully Submitted,

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